THE GEOLOGIC HISTORY OF UTAH

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WALDEN SCHOOL OF LIBERAL ARTS

PURPOSE

- To show with diagrams and animations the geologic history of Utah.
- To help geology students learn the sequence of rock formations in the three geologic provinces of Utah.
- To supplement courses in geology at the high school and college levels.
- Feel free to use or modify this presentation however you choose.

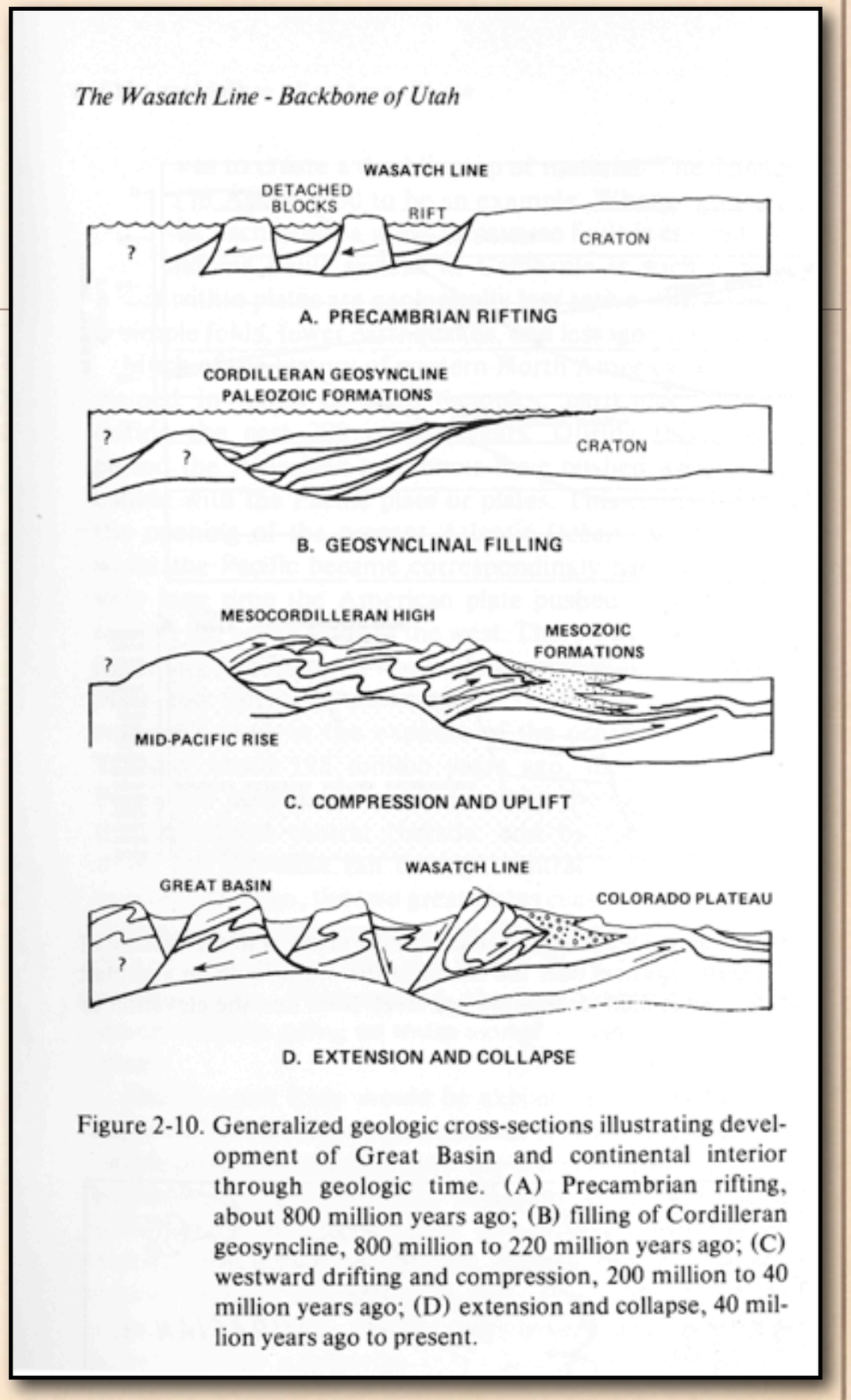
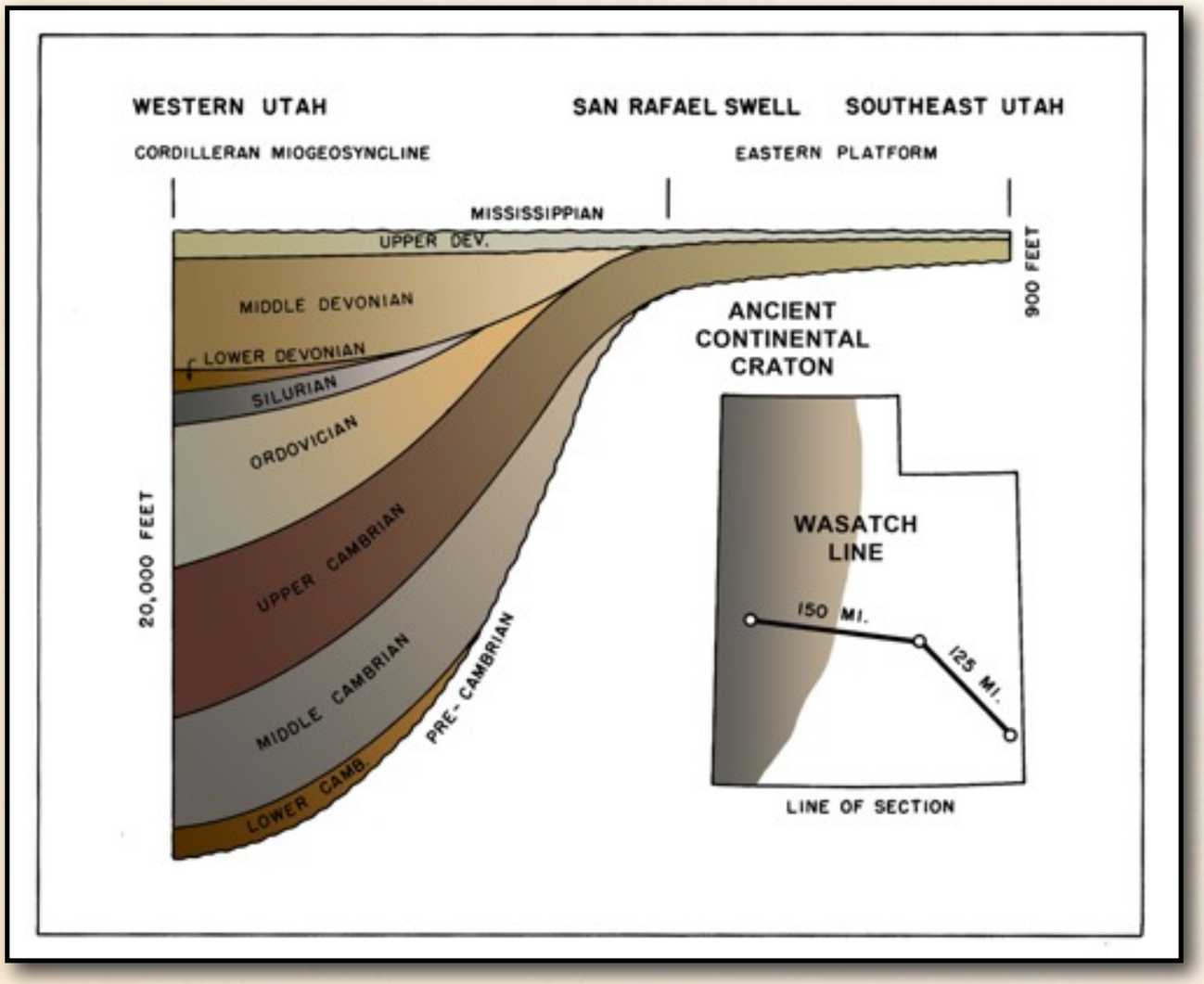


Figure 2-10. Generalized geologic cross-sections illustrating development of Great Basin and continental interior through geologic time. (A) Precambrian rifting, about 800 million years ago; (B) filling of Cordilleran geosyncline, 800 million to 220 million years ago; (C) westward drifting and compression, 200 million to 40 million years ago; (D) extension and collapse, 40 million years ago to present.

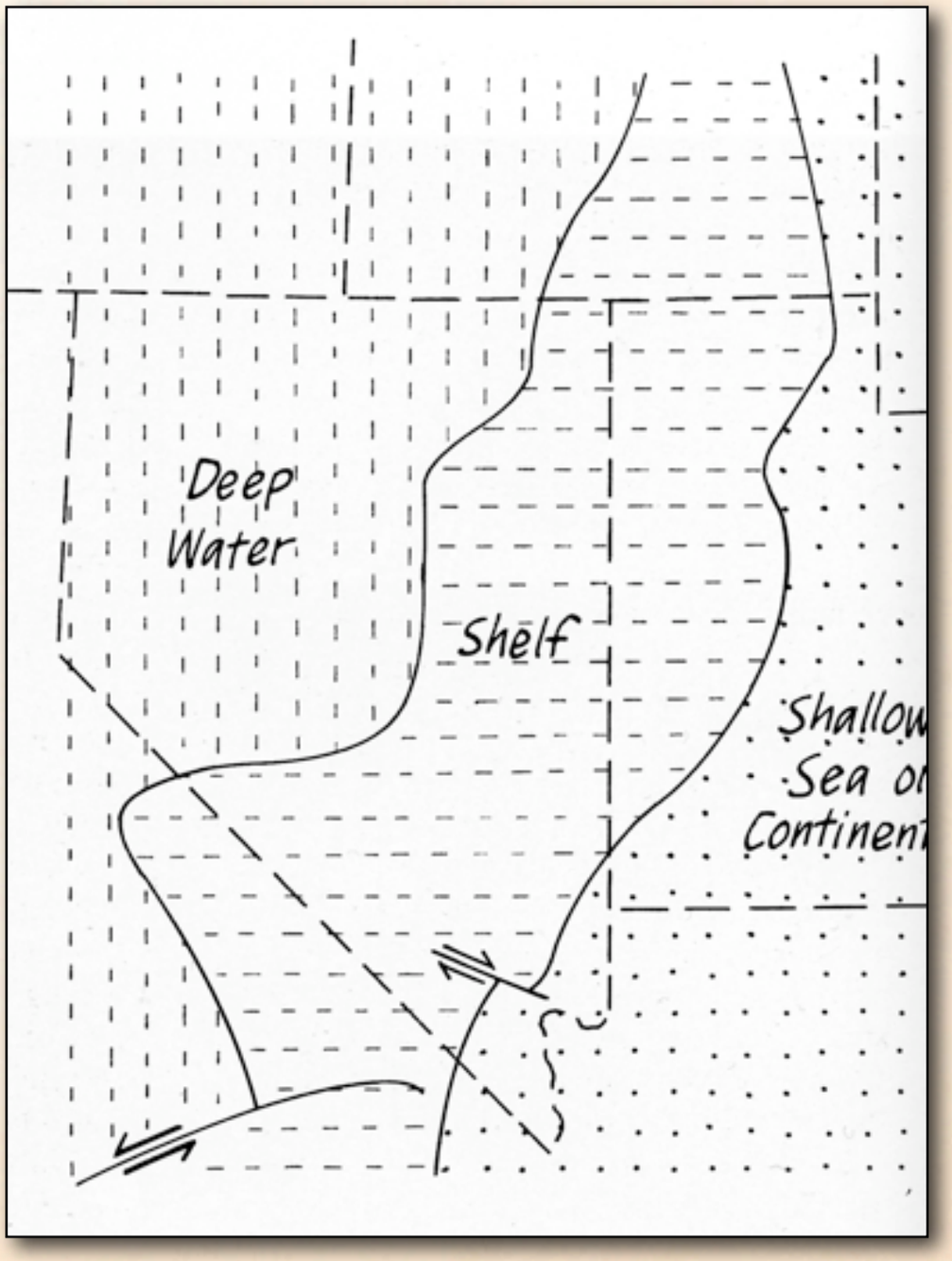
PRECAMBRIAN UTAH



- 800 MY ago: Rifting at the Wasatch Line split western Utah away from the remaining continental craton.
- The eastern section still has craton underneath; the craton is missing in the west (in Asia now??).
- A deep geosyncline formed in the west which filled with sediments (mostly dolomite and limestone).

THE CONTINENTAL EDGE

- The Wasatch Line was the shoreline of the continent.
- A large bay existed where the Uinta Mountains now stand; this bay had large sandy beaches.
- This Wasatch Line has played an important role in Utah's geology ever since.



UTAH SUBMERGED

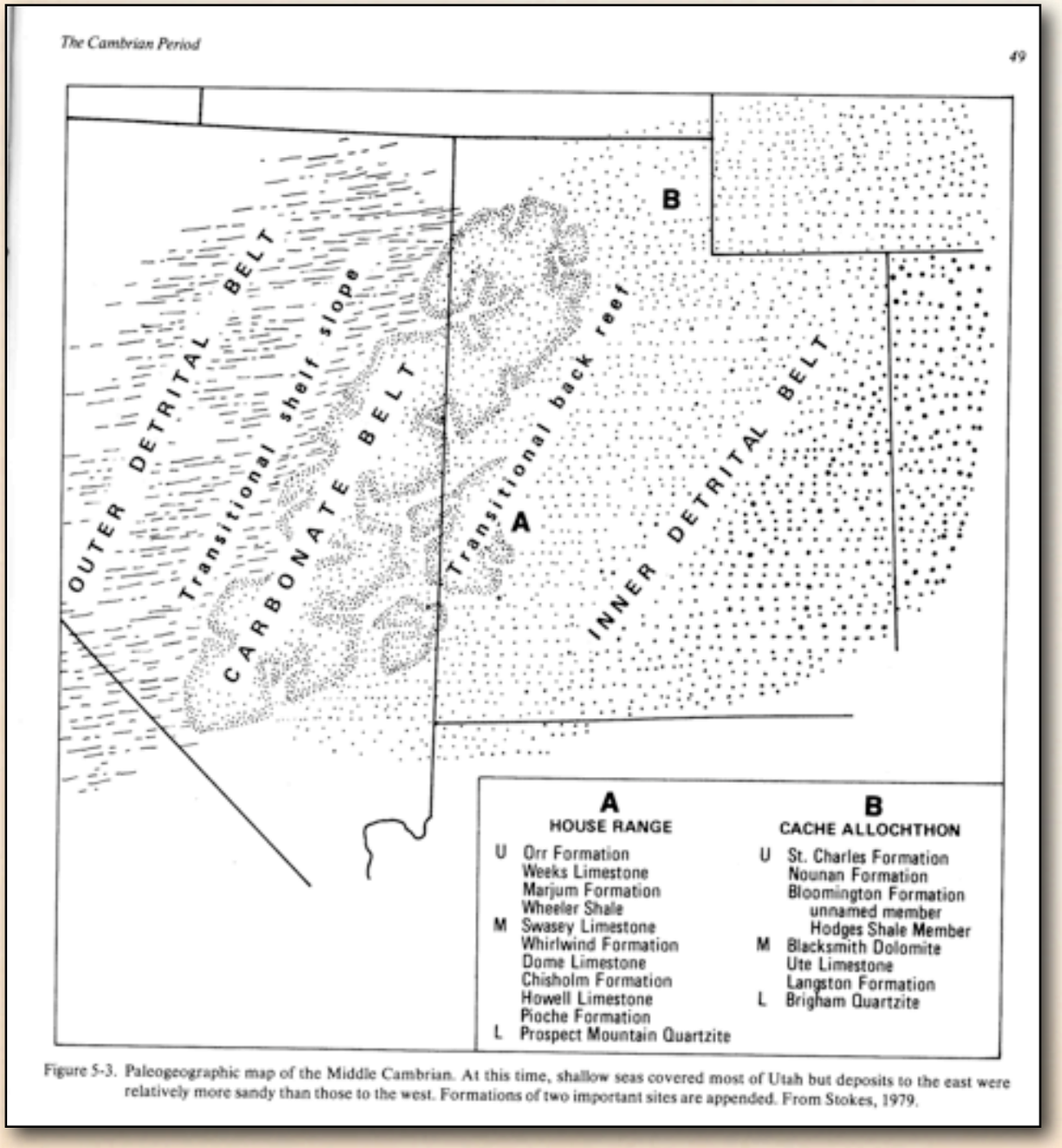
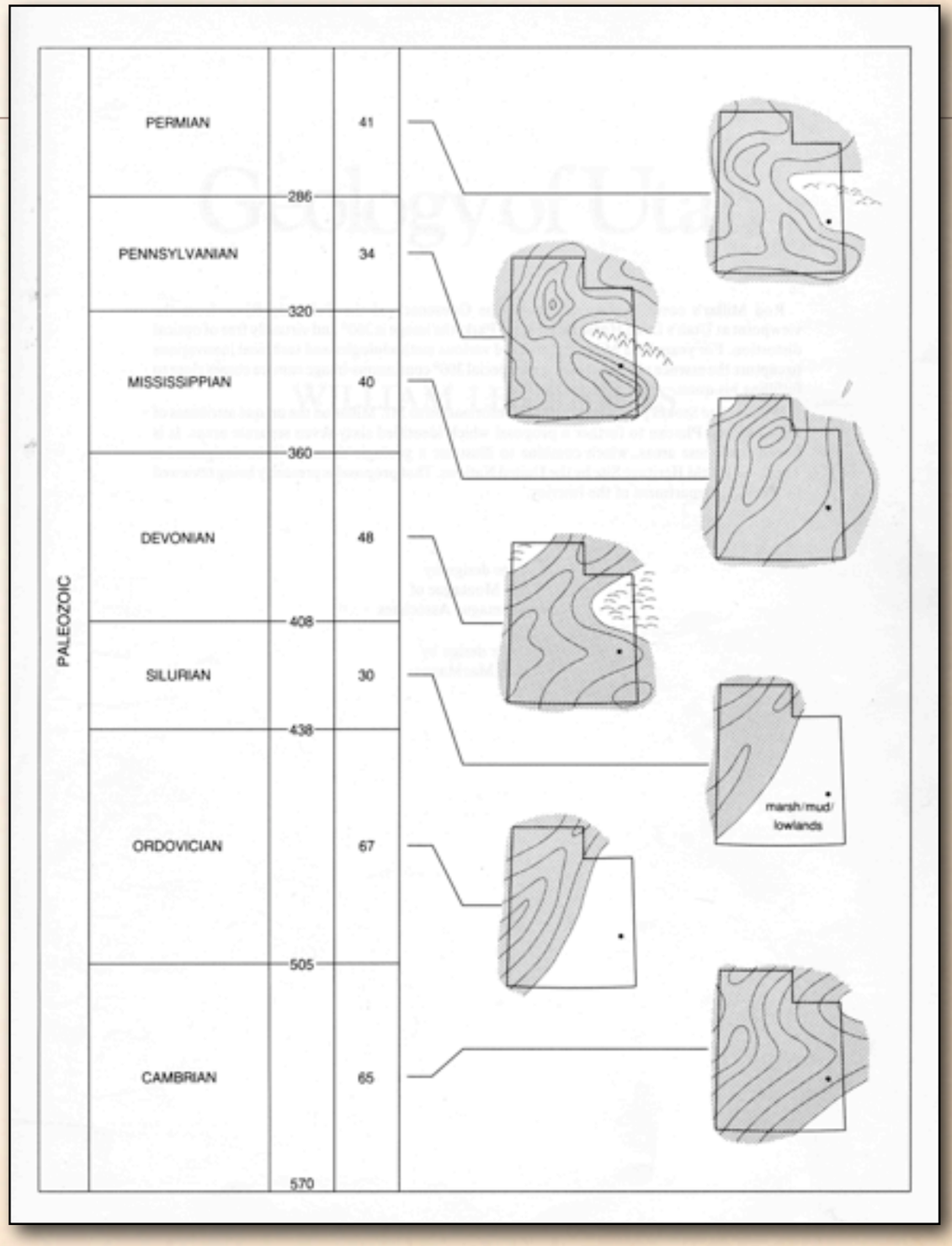


Figure 5-3. Paleogeographic map of the Middle Cambrian. At this time, shallow seas covered most of Utah but deposits to the east were relatively more sandy than those to the west. Formations of two important sites are appended. From Stokes, 1979.

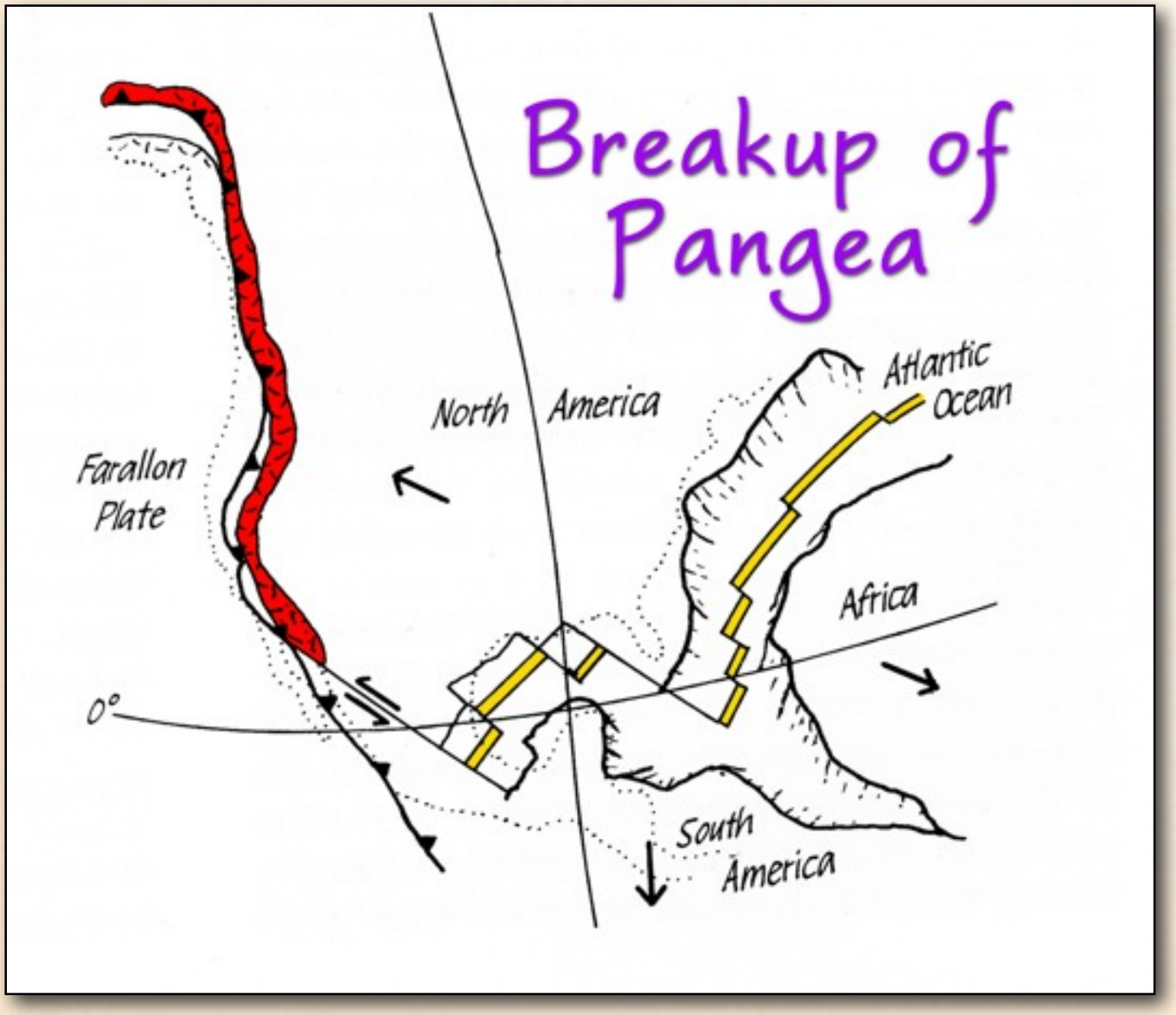
- From 800 MY ago through the Permian Period, Utah was mostly underwater.
- Western Utah was deep water and eastern Utah was more shallow.
- Limestones and dolomites (carbonates) deposited in the west and sandstones and shales in the east.

THE UNCOMPAGHRE UPLIFT

- About 400 MY ago, North America collided with Africa and Europe to form Pangea.
- The Alleghenies, Appalachians, and Ancestral Rockies formed.
- The Uncompaghre Uplift formed on the Utah-Colorado border.
- The Paradox and Oquirrh Basins also formed.



PANGEA BREAKUP



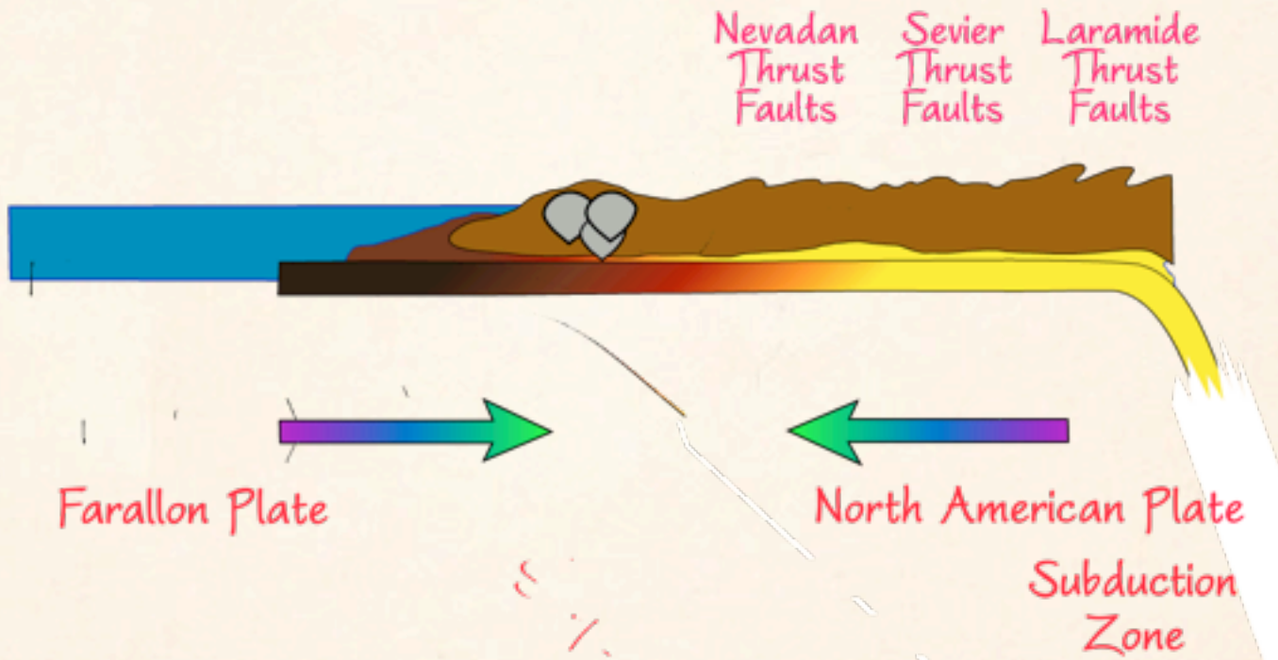
- As North America started to rift away from Pangea, it pushed into the Farallon Plate to the west.
- Subduction and andesitic volcanism formed the Sierra Nevada Mts.
- Utah began to rise above sea level in the Triassic Period.

THE NEVADAN OROGENY

- As the Atlantic Ocean widened, the Farallon Plate was overridden.
- The spreading center was pushed under North America, and subduction became more shallow.
- A wave of thrust faulting and mountain building started in the west and moved eastward across Nevada as the Nevadan Orogeny.

THE NEVADAN OROGENY

Nevadan, Sevier, and Laramide Orogenies



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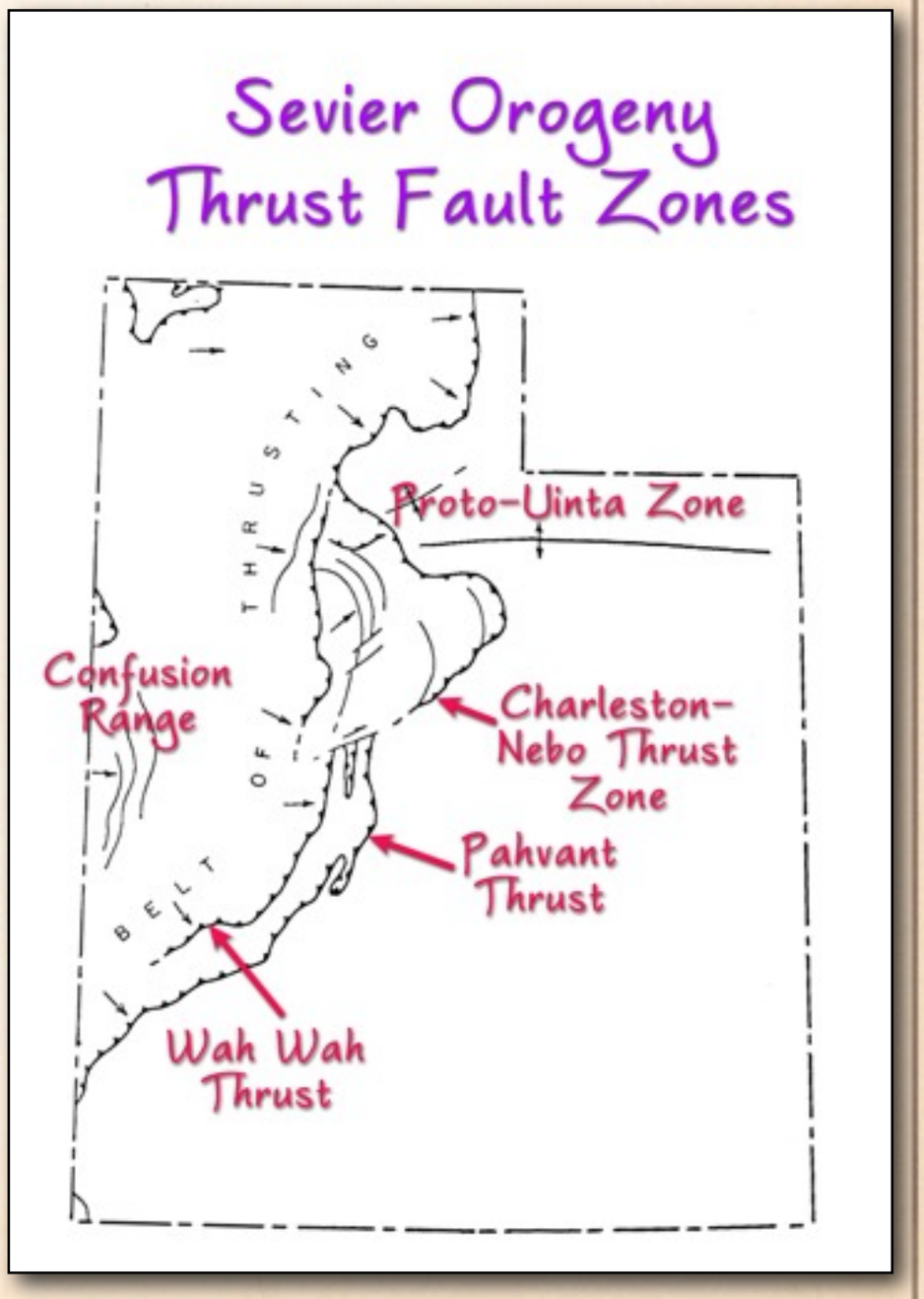
THE SEVIER OROGENY

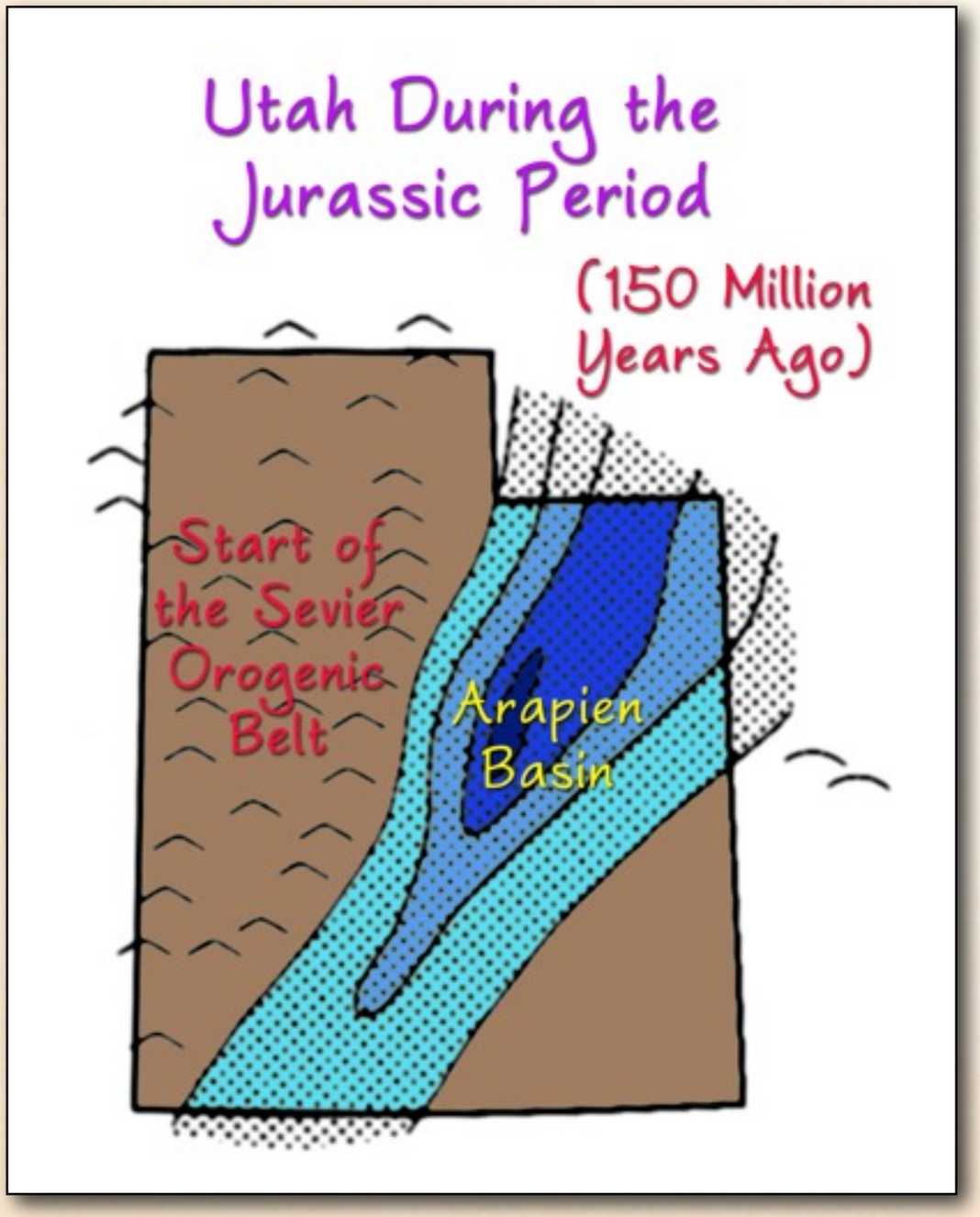
- In the Jurassic Period, the wave of thrust faulting reach western Utah and folded up a tall mountain range in the Sevier Orogeny.

- Sediments washed out of the mountains onto the Colorado Plateau.

- The edge of the thrust zone was the Wasatch Line again.



JURASSIC UTAH



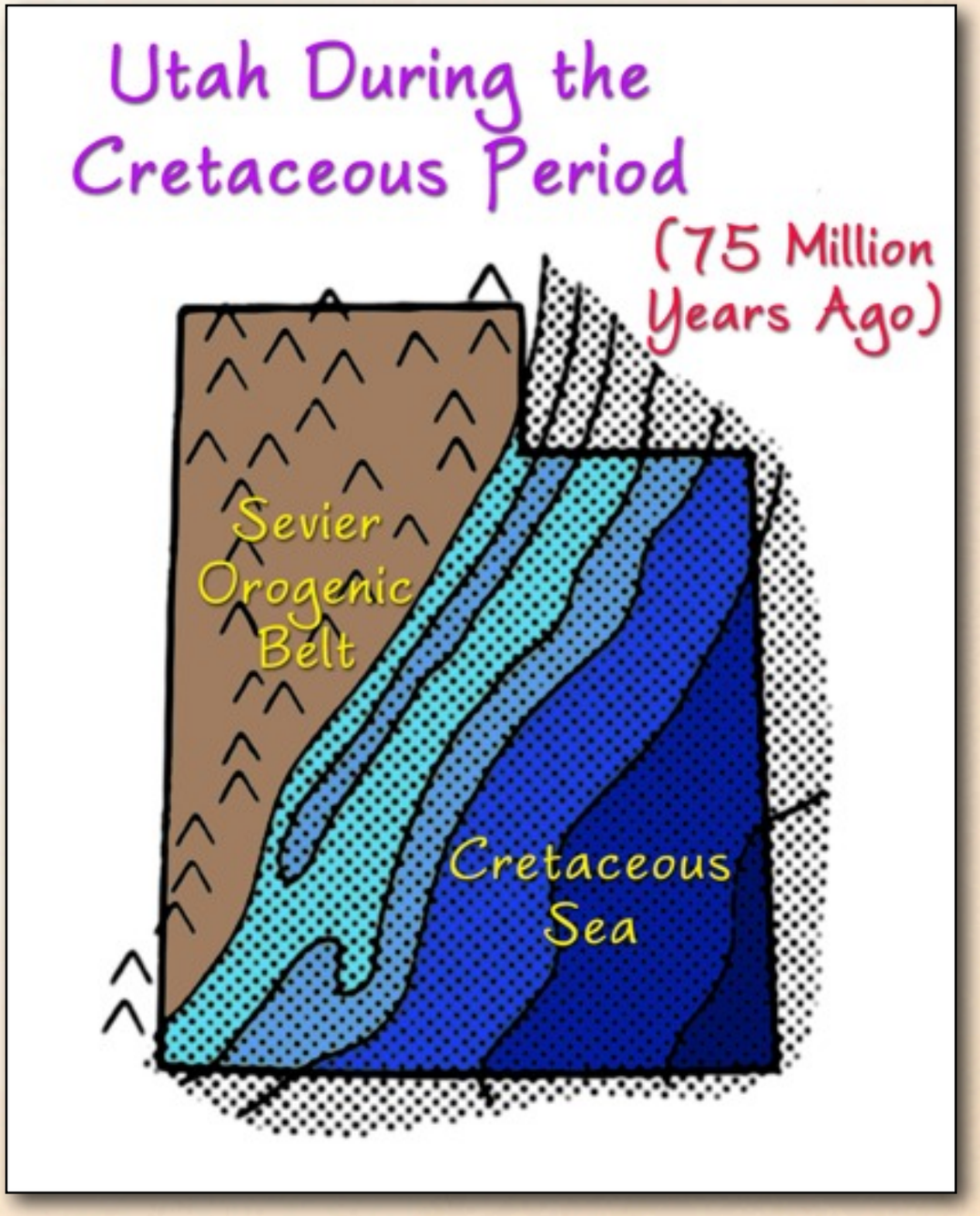
- As the mountains rose to the west, the Colorado Plateau rose up and was covered by a shallow ocean (the Arapien Sea) which filled with sediments.

- Later in the Jurassic, Utah moved into the subtropical high pressure zone and was covered by a huge desert, now preserved in the Navajo Sandstone.

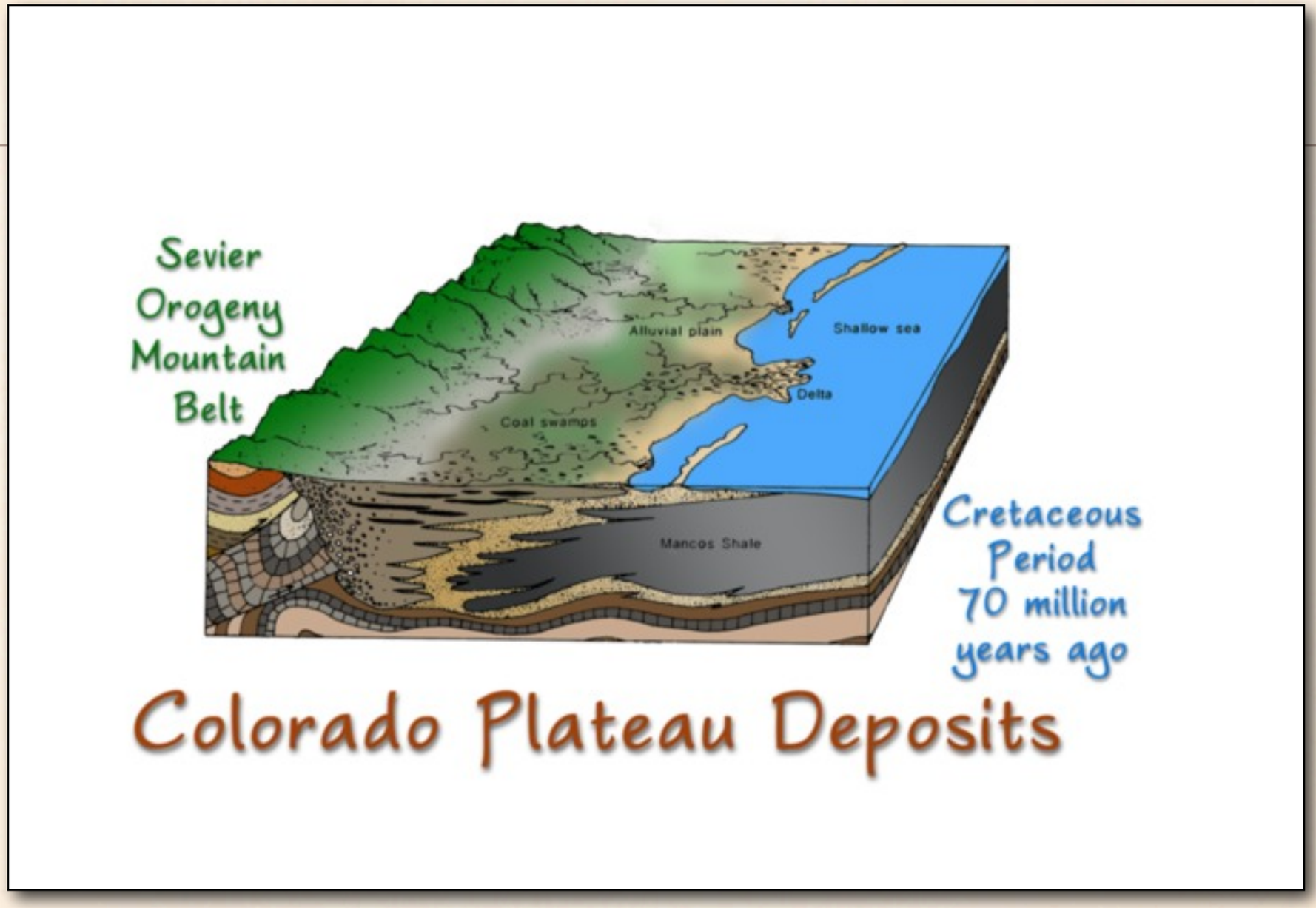
CRETACEOUS UTAH

- The mountains rose higher, but so did the ocean. During the Cretaceous Period, oceans covered most of central North America to the Arctic.

- Coal swamps, shale, and sandstone layers formed along the shores as dinosaurs walked through the mud flats.



COAL DEPOSITS



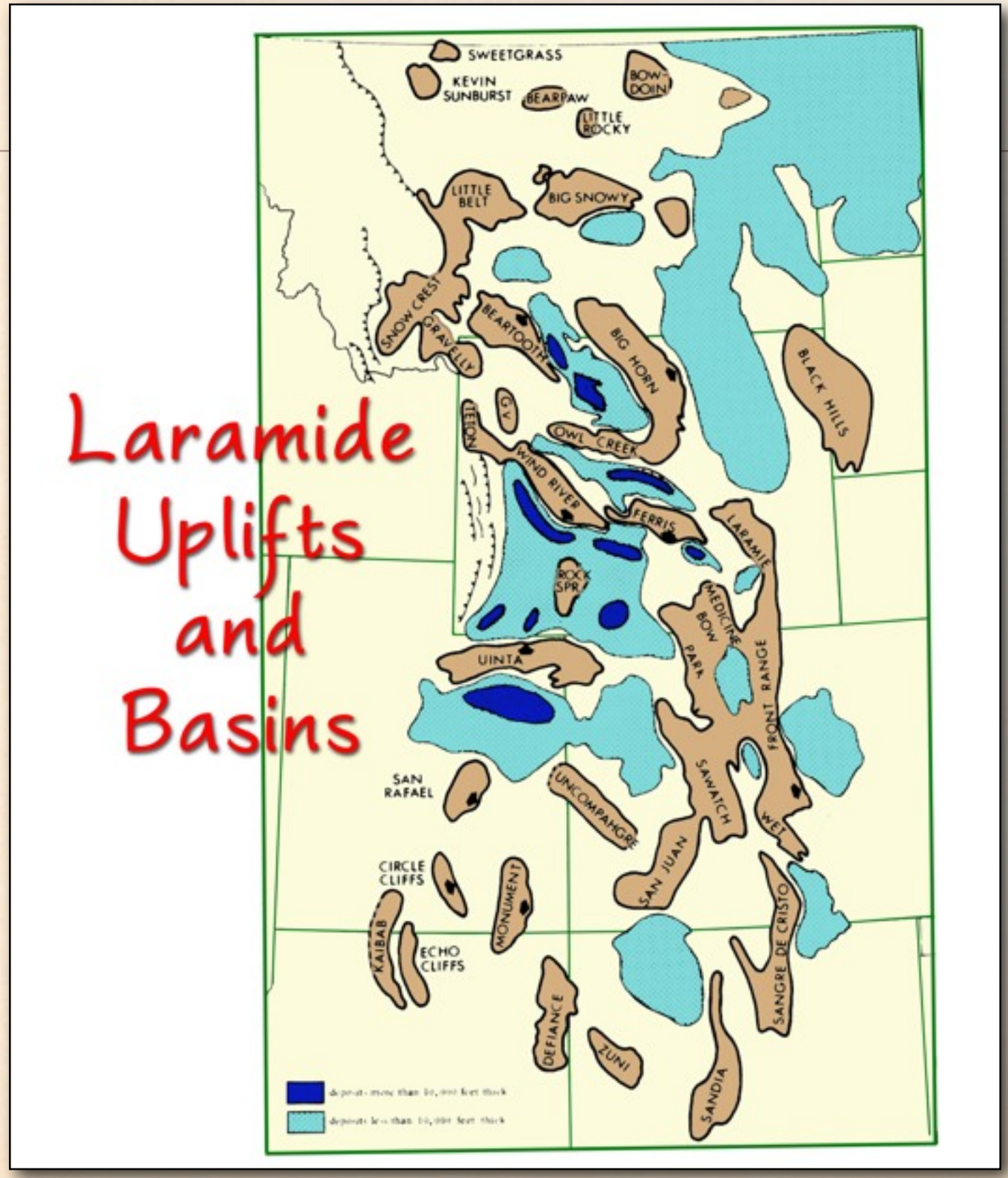
- The shallow Cretaceous Sea rose and fell, and swamps along the edges became buried by shale and sandstone, eventually turning into the coal deposits of the Carbon Crescent of Utah.

THE SAN RAFAEL SWELL

- The mountain building continued eastward, but the thick craton and deposits on the Colorado Plateau prevented thrust faulting.

- Parts of the plateau (the San Rafael, Circle Cliffs, and Monument Valley areas) rose up into anticlines which were then eroded into by rivers.

LARAMIDE OROGENY



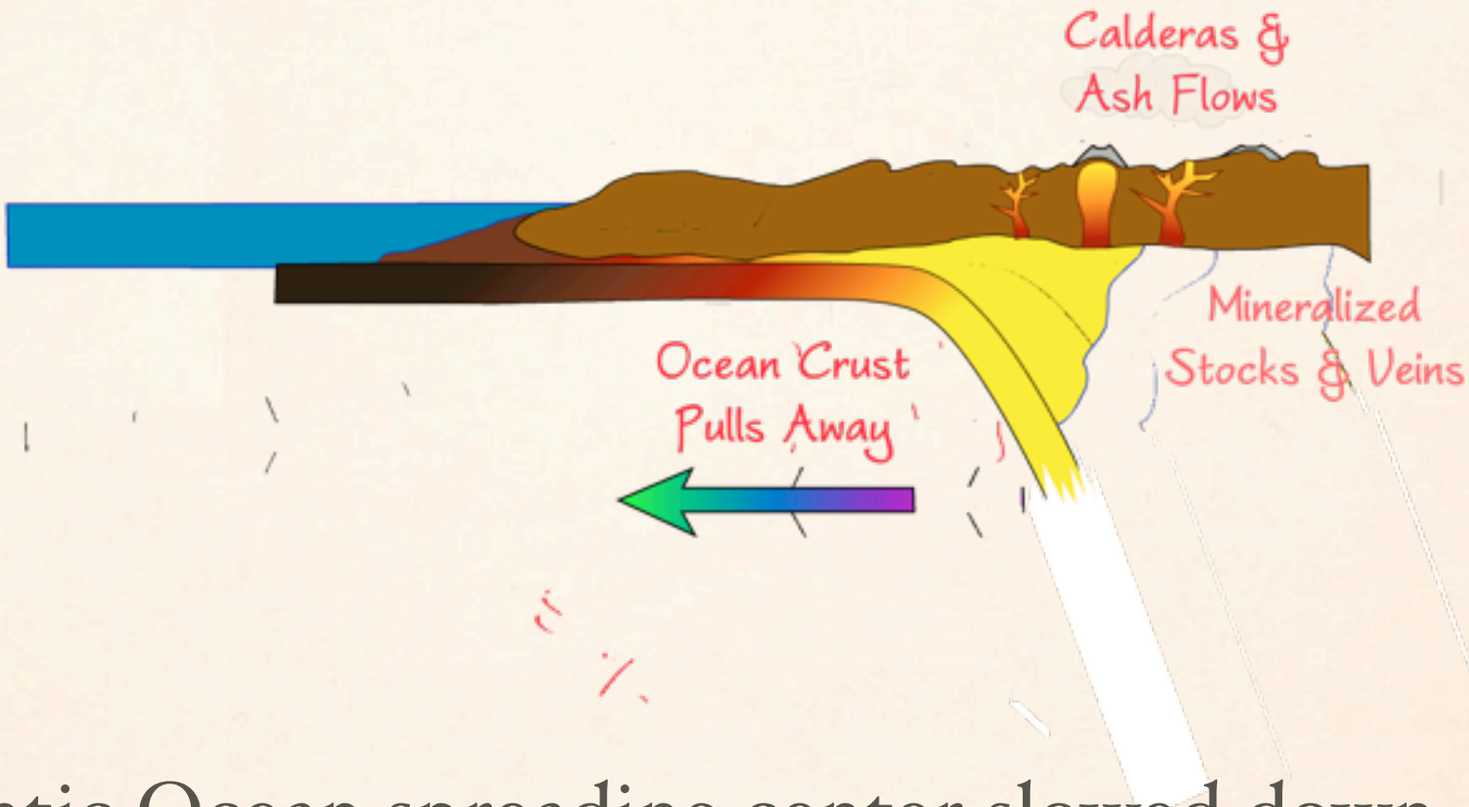
- Once the thrusting reached Colorado, it folded the crust into the present Rocky Mountains about 60-55 MY ago.
- The Uinta Mts. were formed as part of this Laramide Orogeny, as was the Uintah Basin.

SUBDUCTION COLLAPSE

- The Atlantic Ocean spreading center slowed down, and the subduction zone collapsed from under western North America.
- A wave of volcanic activity traveled east to west as the zone pulled away (see the third part of this animation).

SUBDUCTION COLLAPSE

Origins of Mineral Deposits in Colorado, Utah, and Nevada



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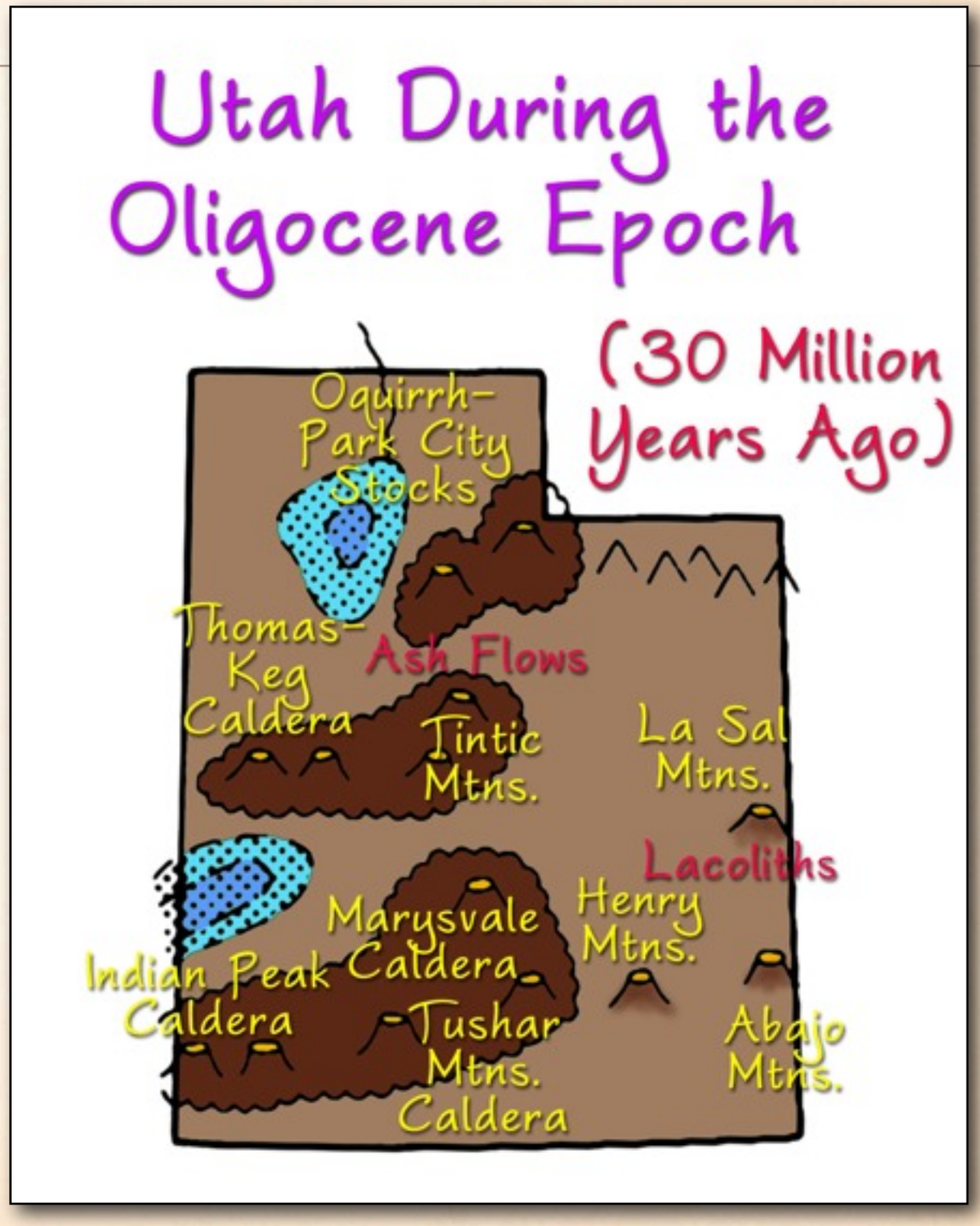
VOLCANIC LACOLITHS

- At three locations under the Colorado Plateau, the volcanism bubbled up blisters of magma under the layers of rock to form lacoliths.
- The overlying rock layers have eroded to expose the granite underneath.
- These form the La Sal, Abajo, and Henry Mountains.

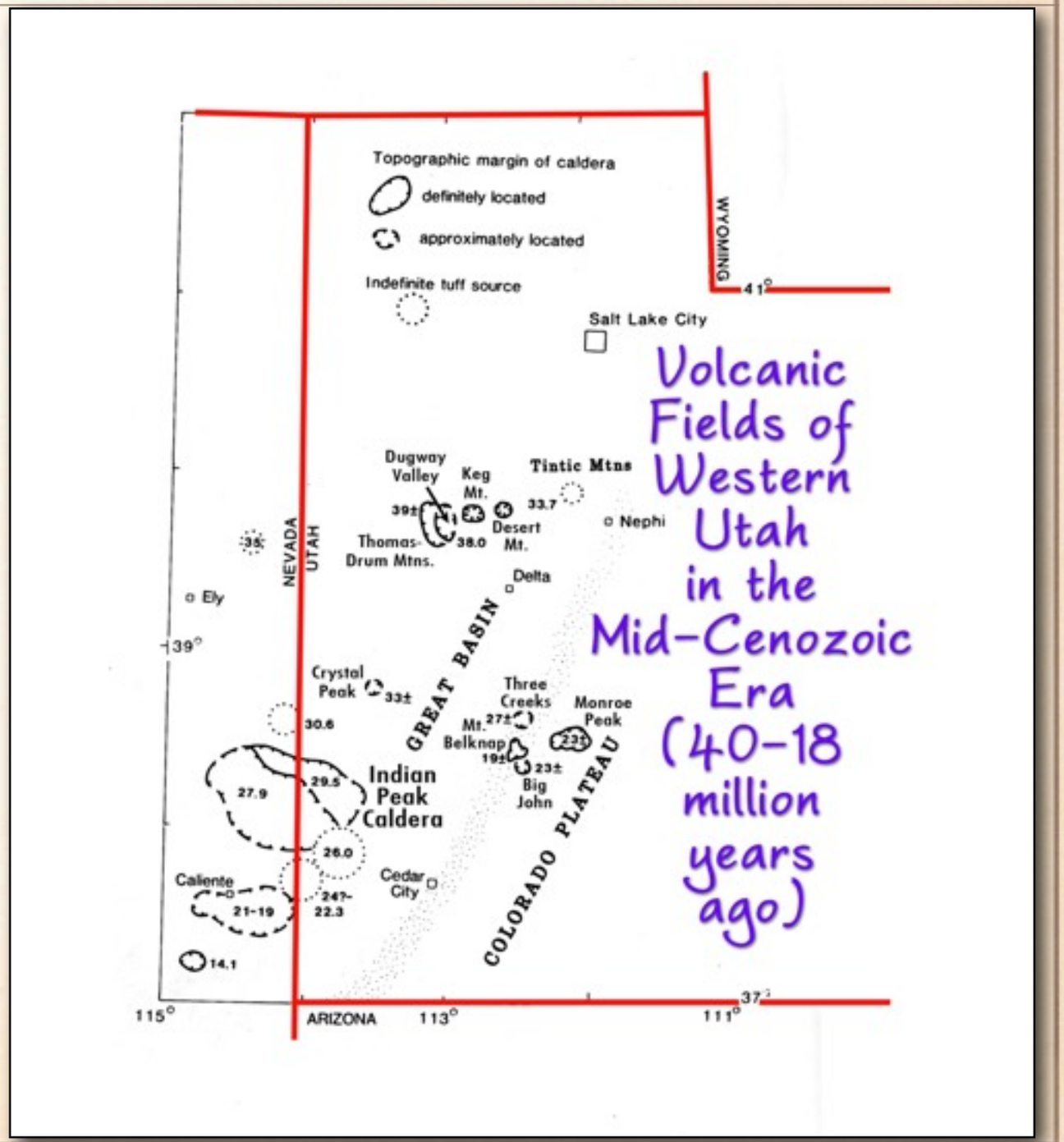


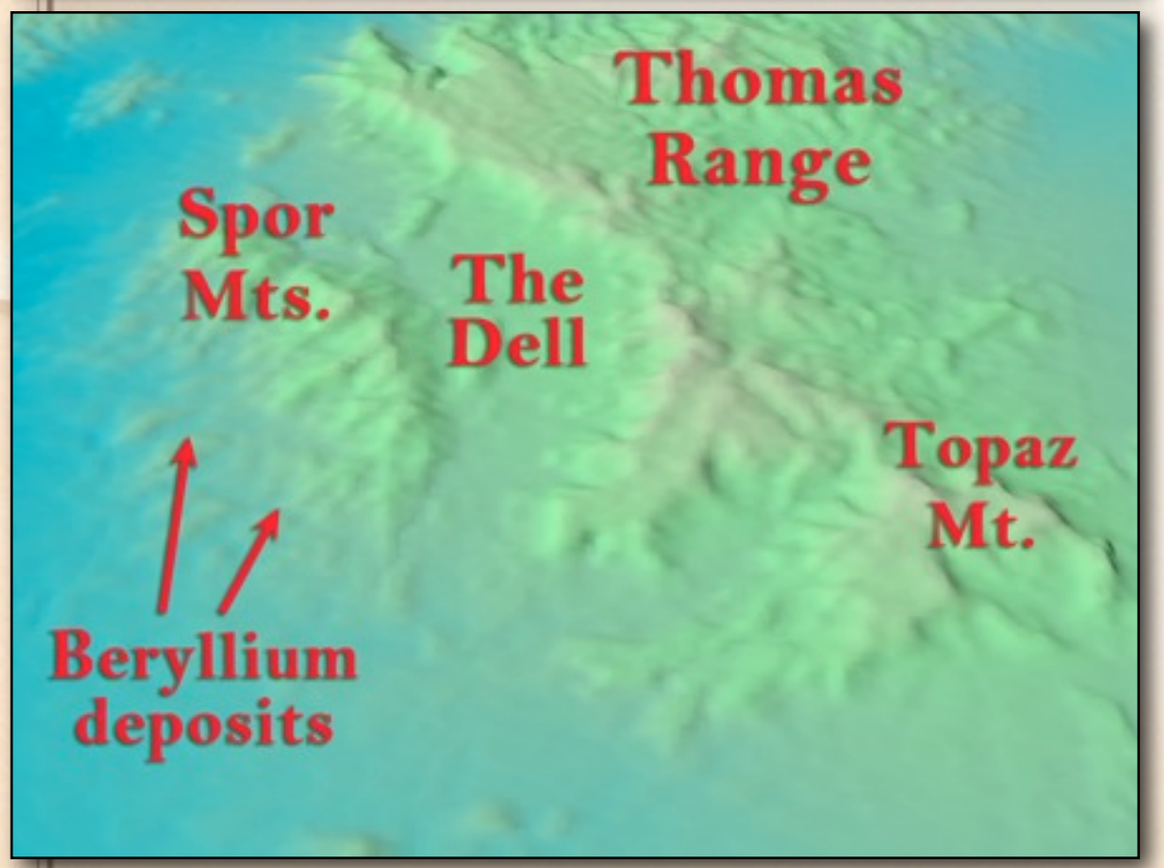
VOLCANIC CALDERAS

- In western Utah, the volcanic activity formed huge calderas in several regions, including the Oquirrh-Park City area, the Wah Wah-Tushar (Indian Peak) area, and the Deep Creek-Thomas-Tintic area.

- Large areas of Utah were covered by volcanic ash.

- Minerals such as silver, gold, molybdenum, zinc, beryllium, iron, copper, etc. were injected into the existing fault zones as stocks and dykes.



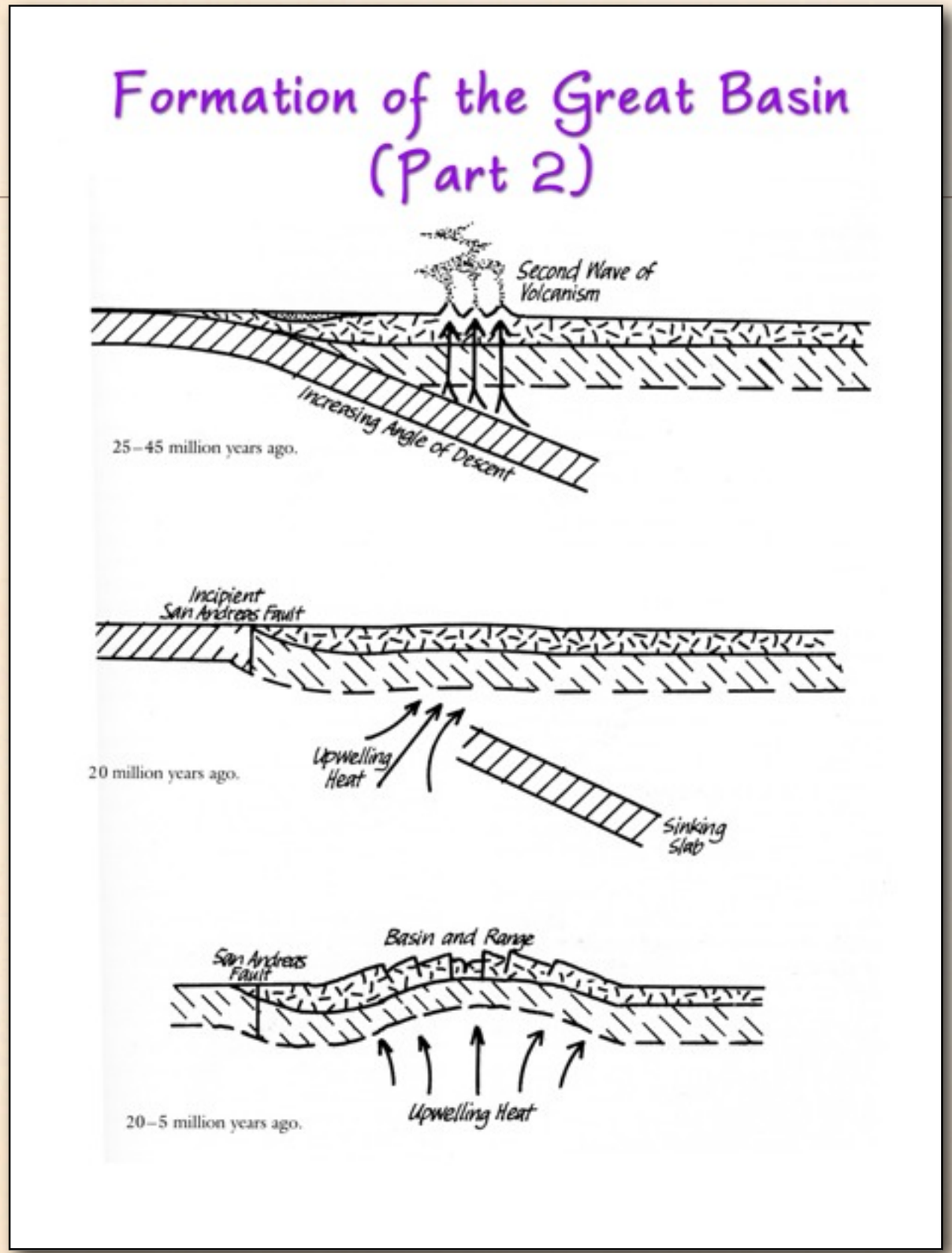


THOMAS RANGE

- For example, many minerals were injected into a volcanic zone that stretched from the Deep Creek Mts. on the Utah-Nevada border through the Thomas-Spor Ranges to the Tintic area.

- Gold was deposited at Gold Hill; beryllium, fluorite, topazes, and uranium in the Spor-Thomas area; and silver, gold, copper, and lead in the Tintic Mining District around Eureka.

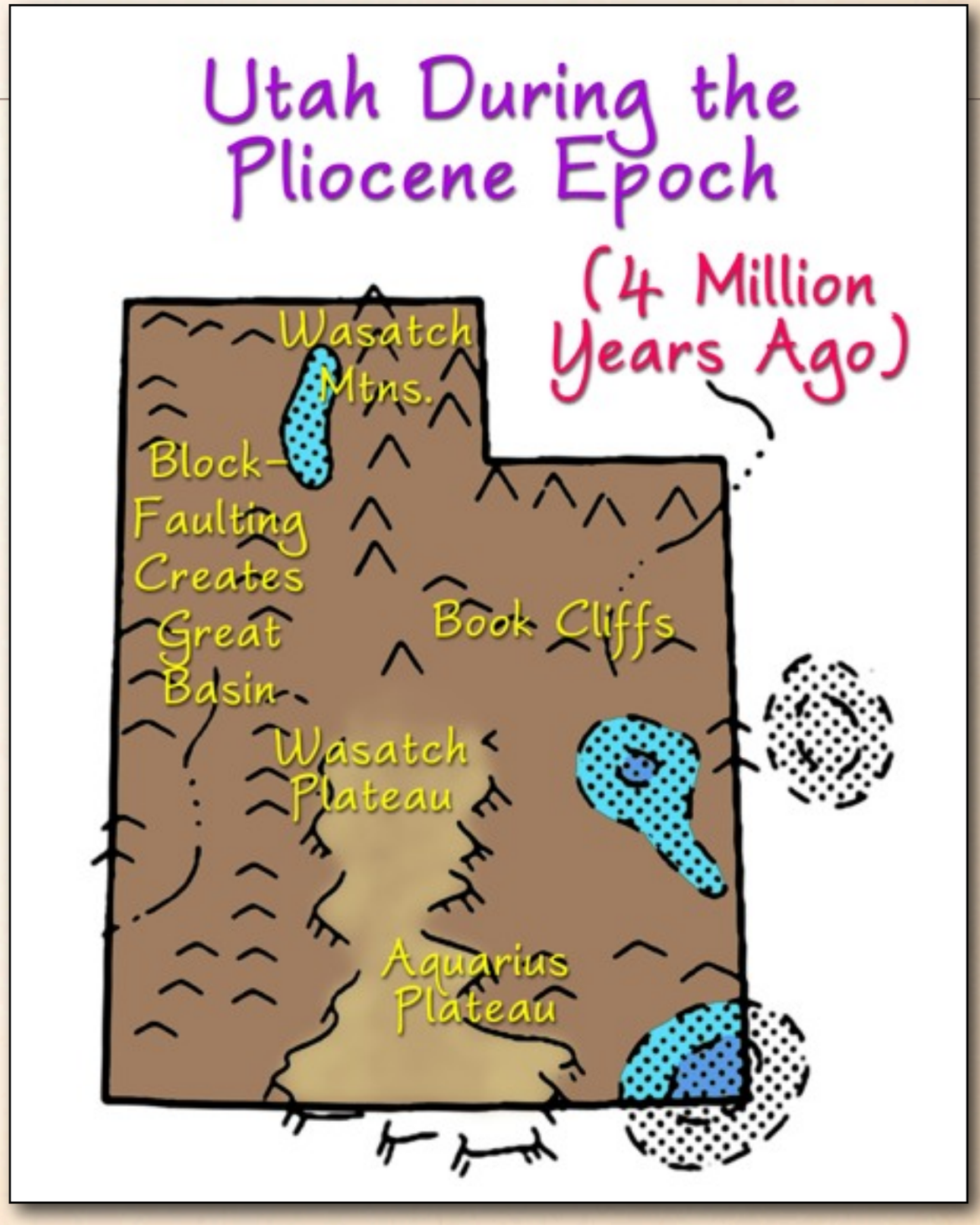
CENOZOIC ERA



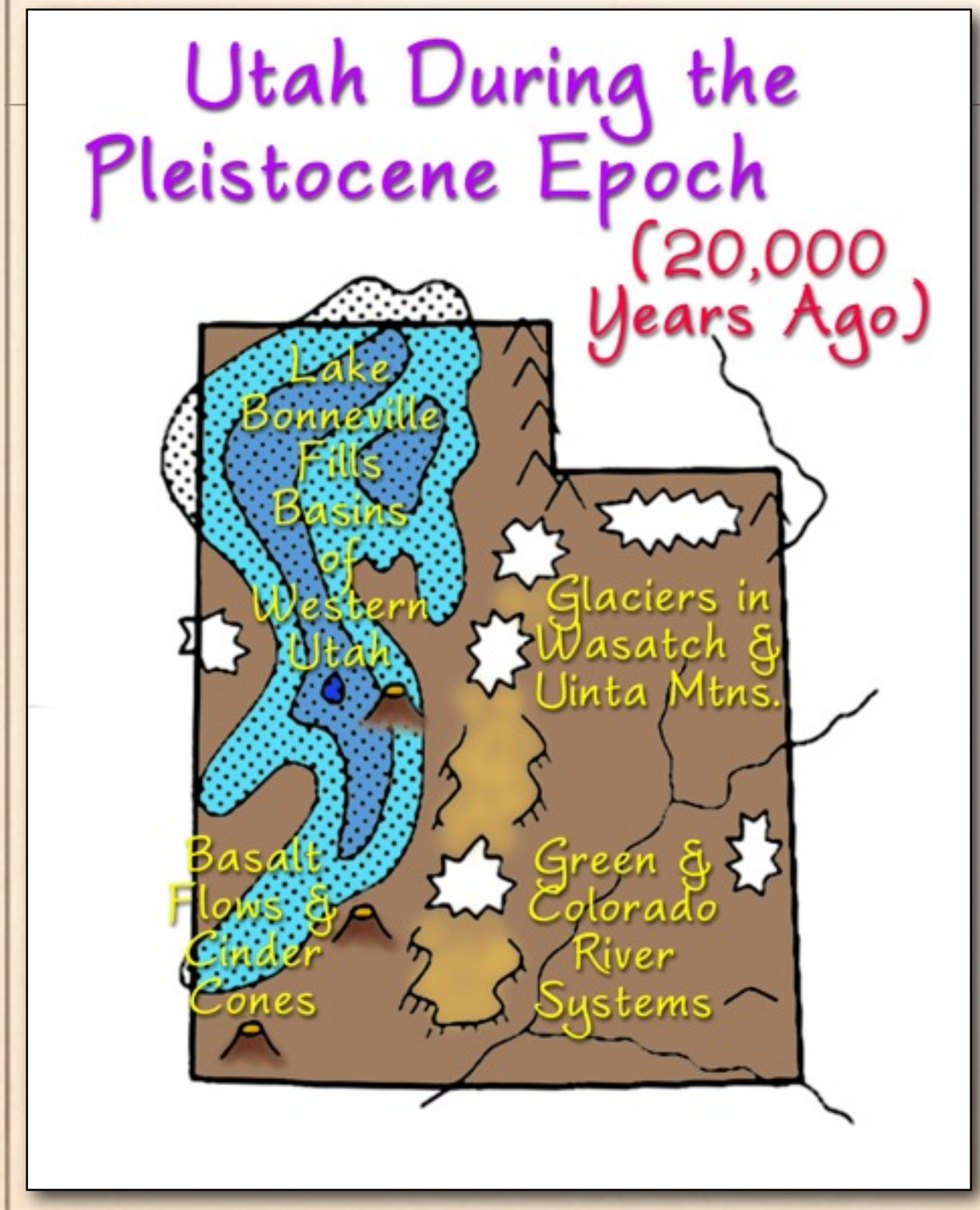
- During the later Cenozoic Era, western Utah began to collapse and stretch as the San Andreas Fault system began to pull western California northward.
- Extensive normal faults developed as the crust spread and sagged.
- A series of parallel mountain ranges formed, and the sagging crust created the Great Basin.

THE GREAT BASIN

- As the crust spread, basalt spread out from fracture zones to form extensive lava flows and cinder cones.
- Major zones included the Pahvant Valley (Sevier Desert) and Snow Canyon areas.
- The Wasatch, Aquarius, Paunsagunt, and other high plateaus formed.



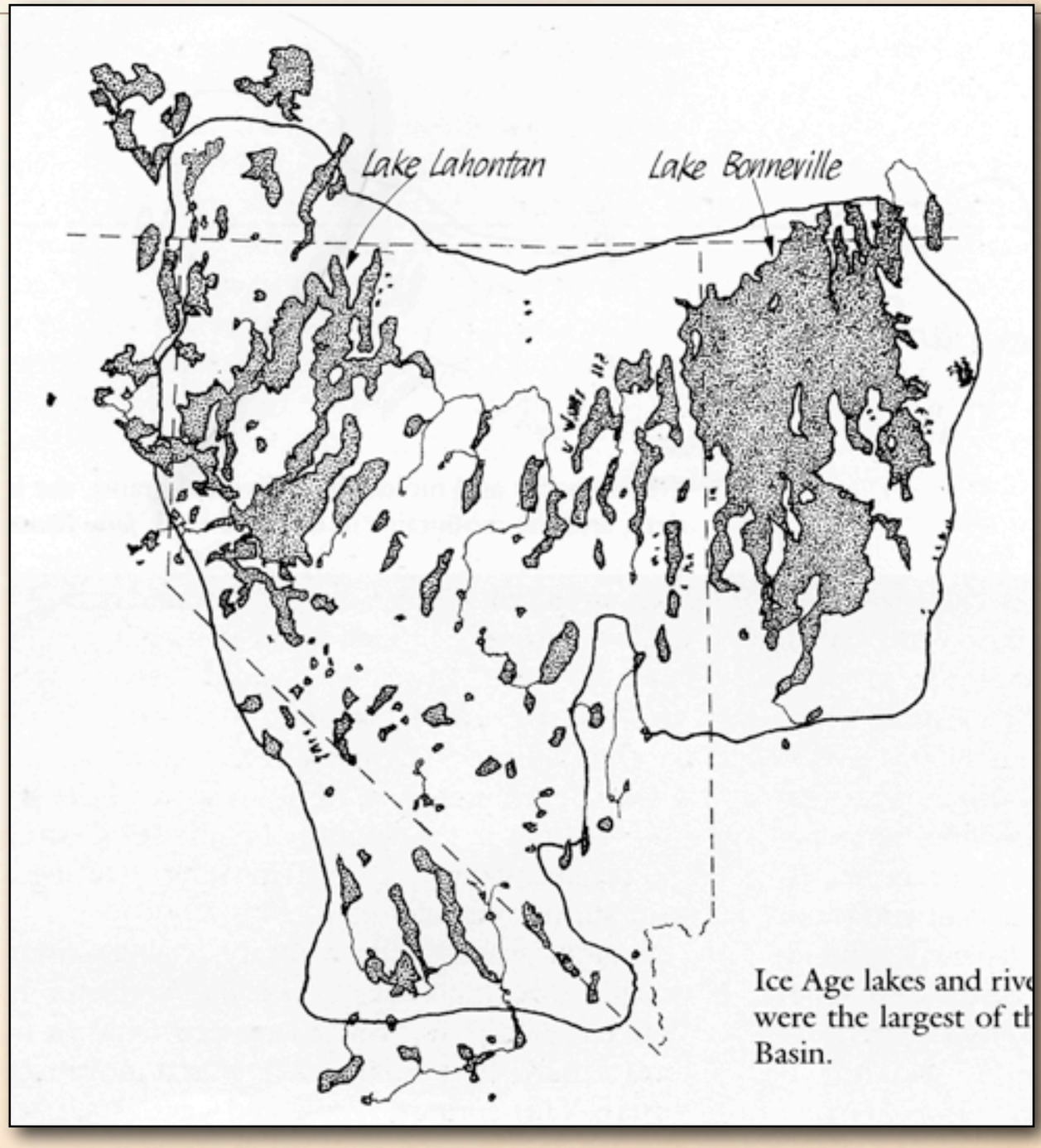
THE ICE AGE



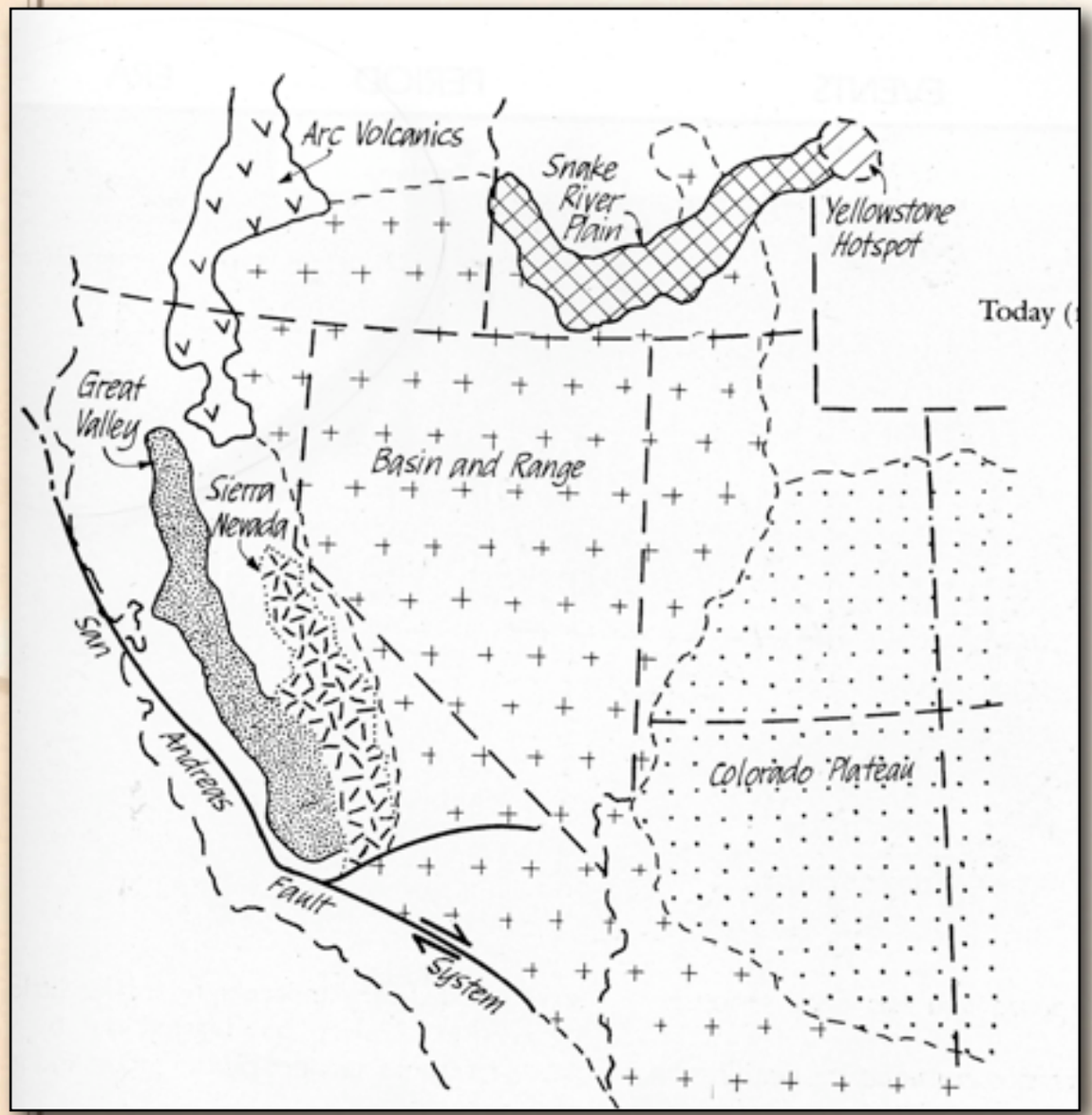
- During the Pleistocene ice age, Utah's climate cooled down and glaciers formed in the mountains.
- The Great Basin valleys had no outlet to the ocean, so they filled up with water.
- Lake Bonneville covered most of western Utah.
- Basalt flows erupted through the lake.

BONNEVILLE SHORELINES

- Lake Bonneville rose until it finally found an outlet at Red Rock Pass in Idaho.
- The lake level rapidly fell, then stabilized. At each level, it created shoreline features such as deltas, benches, and terraces.
- Delta, Utah is built where the Sevier River created a delta as it emptied into Lake Bonneville; BYU and the U of U are built on wave-cut terraces; and Orem is built on a bench.



THE CLIMATE WARMS

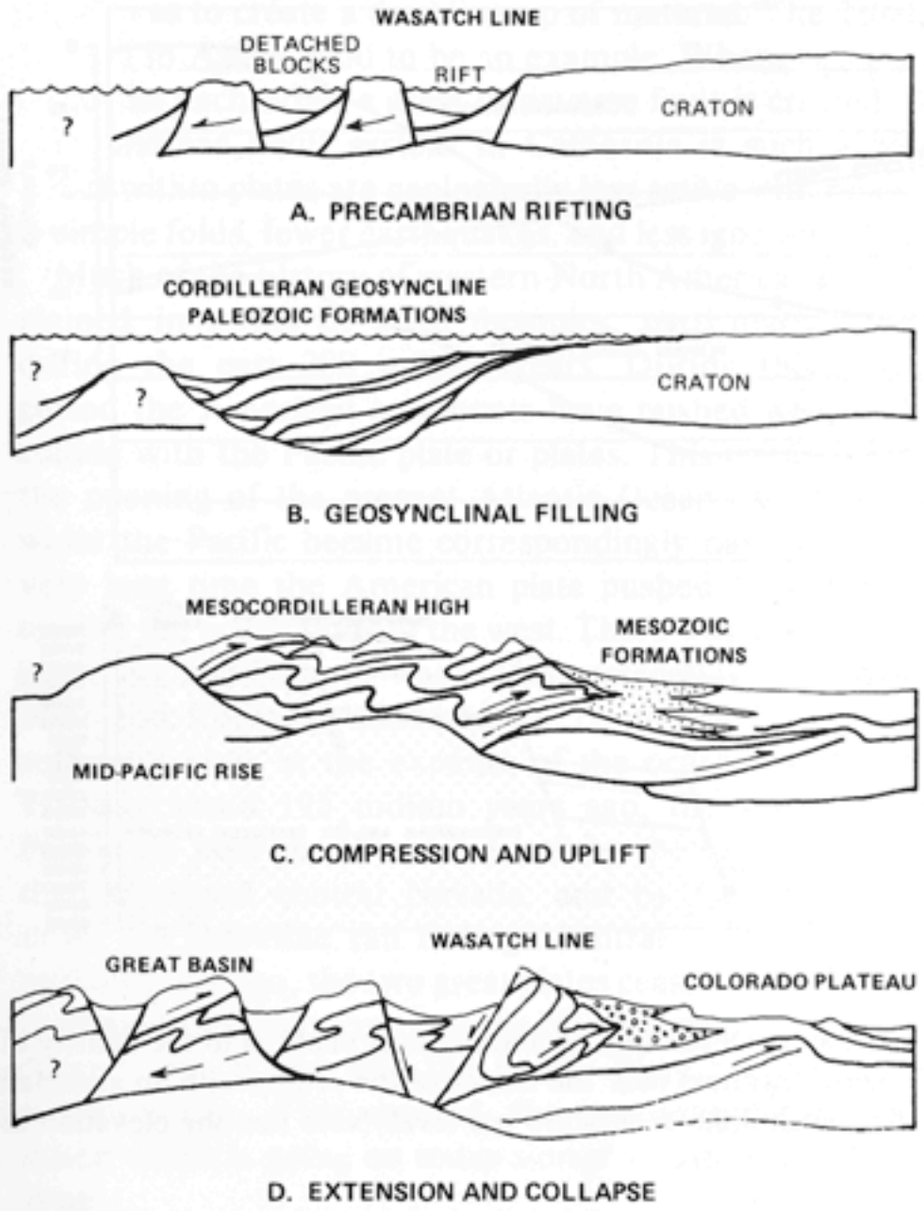


- About 10,000 years ago, the climate began to warm up and has continued to warm.
- Lake Bonneville gradually evaporated and shrank, until today only remnants remain: Utah Lake, Sevier Lake, Bear Lake, and the Great Salt Lake.
- The Great Salt Lake is salty because it is the lowest spot and any salt that washes in stays there.

UTAH TODAY

- Today Utah is divided into three geological zones: The Uinta-Wastach Mts., the Colorado Plateau, and the Great Basin.
- The Wasatch Fault (Wasatch Line) is still the border between east and west.
- Volcanism and normal faulting continue in the west; the east continues to erode and form canyons.

The Wasatch Line - Backbone of Utah



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